

Midterm Exam

Level: 1st Year

Date: 27/11/2024

Material: Algorithms and Static Data Structures

Duration: 1h30

Exercise 1: Swapping (06 points)

Write an algorithm that carries out a swapping of an integer number n ; i.e. that exchanges the high-weight digit with the low-weight digit of an integer number.

Example

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| <ul style="list-style-type: none">• Input:<ul style="list-style-type: none"><input type="radio"/> $n = 5964$<input type="radio"/> $n = -18$<input type="radio"/> $n = 723859$<input type="radio"/> $n = 9$• Output:<ul style="list-style-type: none"><input type="radio"/> 1965<input type="radio"/> -81<input type="radio"/> 923857<input type="radio"/> 9 |
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Requirements

- Perform a detailed analysis with input, output, and main steps.
- Develop an algorithm that handles the swapping.
- Validate the algorithm using the first two example numbers to ensure its correctness.

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Exercise 2: Digit Frequency Counter (07 points)

Write an algorithm that reads an integer number n and counts the frequency of each digit (0..9) in the number using **one (01)** counter only.

Example

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| <ul style="list-style-type: none">• Input:<ul style="list-style-type: none"><input type="radio"/> $n = 122333$• Output:<ul style="list-style-type: none"><input type="radio"/> Digit 1: 1 time(s)<input type="radio"/> Digit 2: 2 time(s)<input type="radio"/> Digit 3: 3 time(s) | <ul style="list-style-type: none">• Input:<ul style="list-style-type: none"><input type="radio"/> $n = 58568$• Output:<ul style="list-style-type: none"><input type="radio"/> Digit 5: 2 time(s)<input type="radio"/> Digit 6: 1 time(s)<input type="radio"/> Digit 8: 2 time(s) |
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Exercise 3: Exponential approximation (07 points)

Write an algorithm that calculates the approximation of e^n with t terms, where t is a positive integer number using **one (01)** loop only.

$$e^n = 1 + \frac{n^1}{1!} + \frac{n^2}{2!} + \frac{n^3}{3!} + \frac{n^4}{4!} + \dots + \frac{n^t}{t!}$$